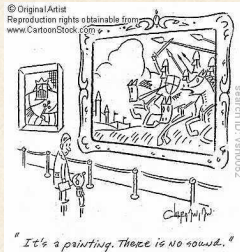UNIVERSITY of WISCONSIN-MADISON
Computer Sciences Department

CS 202: Introduction to Computation   Professor Andrea Arpaci-Dusseau

How can computation create art?

© Original Artist
Reproduction rights obtainable from
www.CartoonStock.com

search ID: cjan0052

" It's a painting. There is no sound. "

What are different approaches of "Computer Art"?

1. Human uses computer to modify digital images

2. Human uses computer as drawing/painting tool

3. Human designs algorithm; computer follows to create exact picture (e.g. drawing in Scratch)

4. Human designs algorithm w/ some randomness, unknown result
   • Human examines results, picks most appealing
   • Or, computer "evaluates" and shows best (according to some metric)

5. Human interacts with computer
   • Algorithm translates pitch to shape; volume to size; movement to color
   • Golan Levin makes art that looks back at you
   • http://www.ted.com/talks/golan_levin_ted2009.html

---

1) Modify Digital Images

Stop everything

facebook

---

2) Computer as Paint Editor

Paint Editor

Import   Clear
Undo Redo

Brush size: ∨   •

Set costume center

OK   Cancel

3) Computer draws same picture by following algorithm

Program (Problem) Specification

- Describes problem to be solved
  - What should outputs be? (as function of inputs)
  - Does **not** say HOW to solve the problem (**not** the algorithm!)
- What is Output? Anything coming out off computer…
  - Anything sent to display (Scratch: Stage)
  - Anything sent to printer
  - Messages sent over network
  - Data stored permanently in files
- What is Input? Anything going into computer…
  - User typing on keyboard
  - Mouse actions
  - Messages arriving over network
  - Data read from files
  - Any other sensors (GPS location, motion)

What is the Specification?

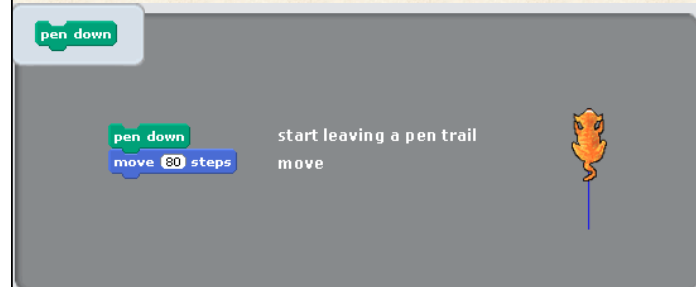Initial state:
- Starts with background

Draws:
- 1 house
- 5 trees on grass
- 3 stars in sky
- Takes no input!

How?

What steps? algorithm?

Art in Scratch: Pen

pen down
move 80 steps

start leaving a pen trail
move

2

Art in Scratch: Pen

set pen color to ☐

```
pen down
set pen color to ■
move 80 steps
set pen color to ■
move 80 steps
```

start leaving a pen trail
set the pen color to blue
move
set the pen color to green
move

To choose a color:

set pen color to ☐ — Get the eye dropper by clicking in the square.

Use the eye droper to click on the color you want.

set pen color to ■ Color appears in square.

Art in Scratch: Pen

set pen size to ◯

```
pen down
set pen color to ■
set pen size to 20
move 50 steps
```

start leaving a pen trail
set the pen color to light blue
set the pen thickness to 20
move

Art in Scratch: Pen

set pen shade to ◯

```
pen down
set pen size to 10
set pen color to ■
set pen shade to 0
repeat 100
    move 2 steps
    set pen shade to pick random 1 to 100
```

start leaving a pen trail
set the pen size to 10
set the pen color to blue
set the pen to darkest shade
repeat 100 times:
    move a little
    set the pen to a
    random shade of blue

0   50   100

the pen shade goes from 0 to 100
50 is the default

Note: If the pen shade is 0, then the pen color will be black.
If the pen shade is 100, the pen color will be white.

Art in Scratch: Stamp

stamp

```
clear
repeat 9
    move 70 steps
    turn ↻ 40 degrees
    stamp
```

clear all the stamps and lines
repeat 9 times:
    move
    turn

stamp a print of your
costume on the stage
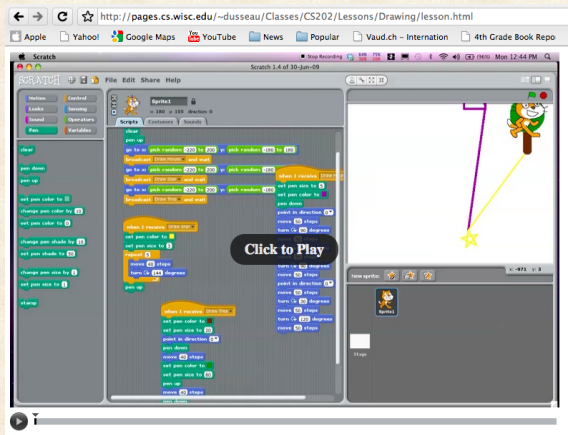
Develop code for house now...

How to Draw a House?

Activate script by clicking flag

Code runs sequentially

Set pen characteristics

Make sure "pen up"

Move to starting point

Put "pen down"

Move Sprite along desired path, using move and turn blocks

Screencast on Course Website

4) Art with Randomness

http://www.kurzweilcyberart.com/aaron/history.html

http://www.kurzweilcyberart.com/aaron/aim_clip_cohen.html

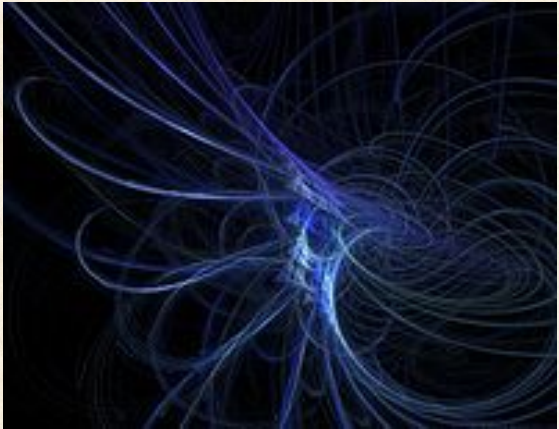## 4) Art with Randomness

4) Art with Randomness

4) Art with Randomness

4) Art with Randomness

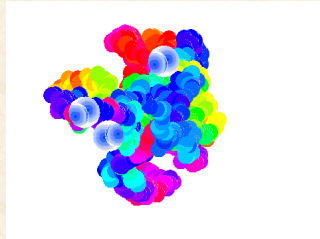## 4) Algorithm with Randomness: Version A: Brownian Motion

Specification?

Initial state
- Stage is empty
- Marker begins in middle of stage

Repeat forever
- Move randomly up/down and left/right
- Change to random (nearby) color
- If reach edge, go back to center

Brownian Motion

Initial state
- Stage is empty
- Marker begins in middle of stage

Repeat forever
- Move randomly up/down and left/right
- Change to random (nearby) color
- If reach edge, go back to center

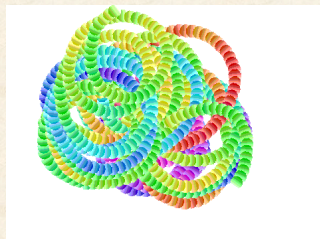## 4) Algorithm with Randomness: Version B: Random Turns

Specification

Initial state
- Stage is empty
- Marker begins in middle

Repeat forever
- Change to random (nearby) color
- Move in irregular arc of circle
- If reach edge, move to center

Random Turns

Initial state
- Stage is empty
- Marker begins in middle

Repeat forever
- Change to random (nearby) color
- Move in irregular arc of circle
- If reach edge, move to center

What does this code forget to do????

Programming Concepts

General
- Think about initial state
- Incrementally test code as you go
- Scripts must be activated to run (when flag clicked)
- Execution within script proceeds sequentially
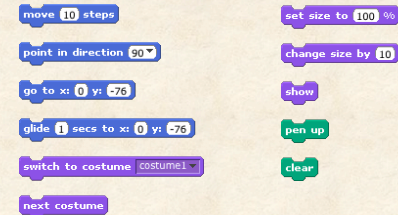- Control : forever, repeat <times>, if <question> then

Blocks in Scratch
- Movement: X-Y coordinate system for Stage
- Pen and stamps
- Random numbers

Today's Checkup

What happens if you don't specify the initial state of your program?

Which are likely to be used for initialization?

move 10 steps   set size to 100 %
point in direction 90   change size by 10
go to x: 0 y: -76   show
glide 1 secs to x: 0 y: -76   pen up
switch to costume costume1   clear
next costume

Announcements

Homework 2 due before class Monday
- See web page for hw details
- Any questions with cs202-tas@cs.wisc.edu

Homework 1 Graded – Available thru Learn@UW

Optional: TED Talk
- Golan Levin makes art that looks back at you
- http://www.ted.com/talks/golan_levin_ted2009.html